

## CIVIL COVER SHEET

The JS 44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. (SEE INSTRUCTIONS ON THE REVERSE OF THE FORM.)

## I. (a) PLAINTIFFS

Innovative Environmental Technologies, Inc.

(b) County of Residence of First Listed Plaintiff Bucks

(EXCEPT IN U.S. PLAINTIFF CASES)

(c) Attorney's (Firm Name, Address, and Telephone Number)

Bryan R. Lentz, Esquire, Gavin P. Lentz, Esquire, Bochetto &amp; Lentz, P.C., 1524 Locust Street, Philadelphia, PA 19102, (215) 735-3900

## DEFENDANTS

Peroxychem, LLC, SCOTT STEFFL AND BRUCE LERNER

County of Residence of First Listed Defendant Philadelphia

(IN U.S. PLAINTIFF CASES ONLY)

NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF THE LAND INVOLVED.

Attorneys (If Known)

## II. BASIS OF JURISDICTION

(Place an "X" in One Box Only)

☐ 1 U.S. Government Plaintiff☒ 3 Federal Question (U.S. Government Not a Party)☐ 2 U.S. Government Defendant☐ 4 Diversity (Indicate Citizenship of Parties in Item III)

## III. CITIZENSHIP OF PRINCIPAL PARTIES

(For Diversity Cases Only)

(Place an "X" in One Box for Plaintiff and One Box for Defendant)

Citizen of This State	<input type="checkbox"/> 1	<input type="checkbox"/> 1	Incorporated or Principal Place of Business In This State	<input type="checkbox"/> 4	<input type="checkbox"/> 4
Citizen of Another State	<input type="checkbox"/> 2	<input type="checkbox"/> 2	Incorporated and Principal Place of Business In Another State	<input type="checkbox"/> 5	<input type="checkbox"/> 5
Citizen or Subject of a Foreign Country	<input type="checkbox"/> 3	<input type="checkbox"/> 3	Foreign Nation	<input type="checkbox"/> 6	<input type="checkbox"/> 6

## IV. NATURE OF SUIT

(Place an "X" in One Box Only)

CONTRACT	TORTS	FORFEITURE/PENALTY	BANKRUPTCY	OTHER STATUTES
<input type="checkbox"/> 110 Insurance <input type="checkbox"/> 120 Marine <input type="checkbox"/> 130 Miller Act <input type="checkbox"/> 140 Negotiable Instrument <input type="checkbox"/> 150 Recovery of Overpayment & Enforcement of Judgment <input type="checkbox"/> 151 Medicare Act <input type="checkbox"/> 152 Recovery of Defaulted Student Loans (Excl. Veterans) <input type="checkbox"/> 153 Recovery of Overpayment of Veteran's Benefits <input type="checkbox"/> 160 Stockholders' Suits <input type="checkbox"/> 190 Other Contract <input type="checkbox"/> 195 Contract Product Liability <input type="checkbox"/> 196 Franchise	<b>PERSONAL INJURY</b> <input type="checkbox"/> 310 Airplane <input type="checkbox"/> 315 Airplane Product Liability <input type="checkbox"/> 320 Assault, Libel & Slander <input type="checkbox"/> 330 Federal Employers' Liability <input type="checkbox"/> 340 Marine <input type="checkbox"/> 345 Marine Product Liability <input type="checkbox"/> 350 Motor Vehicle <input type="checkbox"/> 355 Motor Vehicle Product Liability <input type="checkbox"/> 360 Other Personal Injury <b>PERSONAL INJURY</b> <input type="checkbox"/> 362 Personal Injury - Med. Malpractice <input type="checkbox"/> 365 Personal Injury - Product Liability <input type="checkbox"/> 368 Asbestos Personal Injury Product Liability <b>PERSONAL PROPERTY</b> <input type="checkbox"/> 370 Other Fraud <input type="checkbox"/> 371 Truth in Lending <input type="checkbox"/> 380 Other Personal Property Damage <input type="checkbox"/> 385 Property Damage Product Liability	<input type="checkbox"/> 610 Agriculture <input type="checkbox"/> 620 Other Food & Drug <input type="checkbox"/> 625 Drug Related Seizure of Property 21 USC 881 <input type="checkbox"/> 630 Liquor Laws <input type="checkbox"/> 640 R.R. & Truck <input type="checkbox"/> 650 Airline Regs. <input type="checkbox"/> 660 Occupational Safety/Health <input type="checkbox"/> 690 Other <b>LABOR</b> <input type="checkbox"/> 710 Fair Labor Standards Act <input type="checkbox"/> 720 Labor/Mgmt. Relations <input type="checkbox"/> 730 Labor/Mgmt. Reporting & Disclosure Act <input type="checkbox"/> 740 Railway Labor Act <input type="checkbox"/> 790 Other Labor Litigation <input type="checkbox"/> 791 Empl. Ret. Inc. Security Act <b>IMMIGRATION</b> <input type="checkbox"/> 462 Naturalization Application <input type="checkbox"/> 463 Habeas Corpus - Alien Detainee <input type="checkbox"/> 465 Other Immigration Actions	<input type="checkbox"/> 422 Appeal 28 USC 158 <input type="checkbox"/> 423 Withdrawal 28 USC 157 <b>PROPERTY RIGHTS</b> <input checked="" type="checkbox"/> 820 Copyrights <input type="checkbox"/> 830 Patent <input type="checkbox"/> 840 Trademark <b>SOCIAL SECURITY</b> <input type="checkbox"/> 861 HIA (1395ff) <input type="checkbox"/> 862 Black Lung (923) <input type="checkbox"/> 863 DIWC/DIWW (405(g)) <input type="checkbox"/> 864 SSID Title XVI <input type="checkbox"/> 865 RSI (405(g)) <b>FEDERAL TAX SUITS</b> <input type="checkbox"/> 870 Taxes (U.S. Plaintiff or Defendant) <input type="checkbox"/> 871 IRS—Third Party 26 USC 7609	<input type="checkbox"/> 400 State Reapportionment <input type="checkbox"/> 410 Antitrust <input type="checkbox"/> 430 Banks and Banking <input type="checkbox"/> 450 Commerce <input type="checkbox"/> 460 Deportation <input type="checkbox"/> 470 Racketeer Influenced and Corrupt Organizations <input type="checkbox"/> 480 Consumer Credit <input type="checkbox"/> 490 Cable/Sat TV <input type="checkbox"/> 810 Selective Service <input type="checkbox"/> 850 Securities/Commodities/Exchange <input type="checkbox"/> 875 Customer Challenge 12 USC 3410 <input type="checkbox"/> 890 Other Statutory Actions <input type="checkbox"/> 891 Agricultural Acts <input type="checkbox"/> 892 Economic Stabilization Act <input type="checkbox"/> 893 Environmental Matters <input type="checkbox"/> 894 Energy Allocation Act <input type="checkbox"/> 895 Freedom of Information Act <input type="checkbox"/> 900 Appeal of Fee Determination Under Equal Access to Justice <input type="checkbox"/> 950 Constitutionality of State Statutes
<b>REAL PROPERTY</b> <input type="checkbox"/> 210 Land Condemnation <input type="checkbox"/> 220 Foreclosure <input type="checkbox"/> 230 Rent Lease & Ejectment <input type="checkbox"/> 240 Torts to Land <input type="checkbox"/> 245 Tort Product Liability <input type="checkbox"/> 290 All Other Real Property	<b>CIVIL RIGHTS</b> <input type="checkbox"/> 441 Voting <input type="checkbox"/> 442 Employment <input type="checkbox"/> 443 Housing/Accommodations <input type="checkbox"/> 444 Welfare <input type="checkbox"/> 445 Amer. w/Disabilities - Employment <input type="checkbox"/> 446 Amer. w/Disabilities - Other <input type="checkbox"/> 440 Other Civil Rights	<b>PRISONER PETITIONS</b> <input type="checkbox"/> 510 Motions to Vacate Sentence <b>Habeas Corpus:</b> <input type="checkbox"/> 530 General <input type="checkbox"/> 535 Death Penalty <input type="checkbox"/> 540 Mandamus & Other <input type="checkbox"/> 550 Civil Rights <input type="checkbox"/> 555 Prison Condition		

## V. ORIGIN

(Place an "X" in One Box Only)

☒ 1 Original Proceeding ☐ 2 Removed from State Court ☐ 3 Remanded from Appellate Court ☐ 4 Reinstated or Reopened ☐ 5 Transferred from another district (specify) ☐ 6 Multidistrict Litigation ☐ 7 Appeal to District Judge from Magistrate Judgment

## VI. CAUSE OF ACTION

Cite the U.S. Civil Statute under which you are filing (Do not cite jurisdictional statutes unless diversity):

28 U.S.C. 1331 §§ and 1338(a) and 28 U.S.C. §§ 1391

Brief description of cause:

Patent Infringement Claim

## VII. REQUESTED IN COMPLAINT:

☐ CHECK IF THIS IS A CLASS ACTION UNDER F.R.C.P. 23

 DEMAND \$ in excess of CHECK YES only if demanded in complaint:  
 \$5 Million Dollars **EMERGENCY DEMAND:** ☒ Yes ☐ No

## VIII. RELATED CASE(S) IF ANY

(See instructions):

JUDGE

DOCKET NUMBER

DATE

SIGNATURE OF ATTORNEY OF RECORD

FOR OFFICE USE ONLY

RECEIPT # \_\_\_\_\_ AMOUNT \_\_\_\_\_ APPLYING IFP \_\_\_\_\_ JUDGE \_\_\_\_\_ MAG. JUDGE \_\_\_\_\_

**INSTRUCTIONS FOR ATTORNEYS COMPLETING CIVIL COVER SHEET FORM JS 44****Authority For Civil Cover Sheet**

The JS 44 civil cover sheet and the information contained herein neither replaces nor supplements the filings and service of pleading or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. Consequently, a civil cover sheet is submitted to the Clerk of Court for each civil complaint filed. The attorney filing a case should complete the form as follows:

**I. (a) Plaintiffs-Defendants.** Enter names (last, first, middle initial) of plaintiff and defendant. If the plaintiff or defendant is a government agency, use only the full name or standard abbreviations. If the plaintiff or defendant is an official within a government agency, identify first the agency and then the official, giving both name and title.

(b) County of Residence. For each civil case filed, except U.S. plaintiff cases, enter the name of the county where the first listed plaintiff resides at the time of filing. In U.S. plaintiff cases, enter the name of the county in which the first listed defendant resides at the time of filing. (NOTE: In land condemnation cases, the county of residence of the "defendant" is the location of the tract of land involved.)

(c) Attorneys. Enter the firm name, address, telephone number, and attorney of record. If there are several attorneys, list them on an attachment, noting in this section "(see attachment)".

**II. Jurisdiction.** The basis of jurisdiction is set forth under Rule 8(a), F.R.C.P., which requires that jurisdictions be shown in pleadings. Place an "X" in one of the boxes. If there is more than one basis of jurisdiction, precedence is given in the order shown below.

United States plaintiff. (1) Jurisdiction based on 28 U.S.C. 1345 and 1348. Suits by agencies and officers of the United States are included here.

United States defendant. (2) When the plaintiff is suing the United States, its officers or agencies, place an "X" in this box.

Federal question. (3) This refers to suits under 28 U.S.C. 1331, where jurisdiction arises under the Constitution of the United States, an amendment to the Constitution, an act of Congress or a treaty of the United States. In cases where the U.S. is a party, the U.S. plaintiff or defendant code takes precedence, and box 1 or 2 should be marked.

Diversity of citizenship. (4) This refers to suits under 28 U.S.C. 1332, where parties are citizens of different states. When Box 4 is checked, the citizenship of the different parties must be checked. (See Section III below; federal question actions take precedence over diversity cases.)

**III. Residence (citizenship) of Principal Parties.** This section of the JS 44 is to be completed if diversity of citizenship was indicated above. Mark this section for each principal party.

**IV. Nature of Suit.** Place an "X" in the appropriate box. If the nature of suit cannot be determined, be sure the cause of action, in Section VI below, is sufficient to enable the deputy clerk or the statistical clerks in the Administrative Office to determine the nature of suit. If the cause fits more than one nature of suit, select the most definitive.

**V. Origin.** Place an "X" in one of the seven boxes.

Original Proceedings. (1) Cases which originate in the United States district courts.

Removed from State Court. (2) Proceedings initiated in state courts may be removed to the district courts under Title 28 U.S.C., Section 1441. When the petition for removal is granted, check this box.

Remanded from Appellate Court. (3) Check this box for cases remanded to the district court for further action. Use the date of remand as the filing date.

Reinstated or Reopened. (4) Check this box for cases reinstated or reopened in the district court. Use the reopening date as the filing date.

Transferred from Another District. (5) For cases transferred under Title 28 U.S.C. Section 1404(a). Do not use this for within district transfers or multidistrict litigation transfers.

Multidistrict Litigation. (6) Check this box when a multidistrict case is transferred into the district under authority of Title 28 U.S.C. Section 1407. When this box is checked, do not check (5) above.

Appeal to District Judge from Magistrate Judgment. (7) Check this box for an appeal from a magistrate judge's decision.

**VI. Cause of Action.** Report the civil statute directly related to the cause of action and give a brief description of the cause. **Do not cite jurisdictional statutes unless diversity.** Example: U.S. Civil Statute: 47 USC 553  
Brief Description: Unauthorized reception of cable service

**VII. Requested in Complaint.** Class Action. Place an "X" in this box if you are filing a class action under Rule 23, F.R.Cv.P.

Demand. In this space enter the dollar amount (in thousands of dollars) being demanded or indicate other demand such as a preliminary injunction.

Jury Demand. Check the appropriate box to indicate whether or not a jury is being demanded.

**VIII. Related Cases.** This section of the JS 44 is used to reference related pending cases if any. If there are related pending cases, insert the docket numbers and the corresponding judge names for such cases.

**Date and Attorney Signature.** Date and sign the civil cover sheet.

**FOR THE EASTERN DISTRICT OF PENNSYLVANIA — DESIGNATION FORM** to be used by counsel to indicate the category of the case for the purpose of assignment to appropriate calendar.Address of Plaintiff: 6071 Easton Road, Pipersville, Pennsylvania, 18947Address of Defendant: See attached listPlace of Accident, Incident or Transaction: Eastern District of Pennsylvania  
(Use Reverse Side For Additional Space)

Does this civil action involve a nongovernmental corporate party with any parent corporation and any publicly held corporation owning 10% or more of its stock?

(Attach two copies of the Disclosure Statement Form in accordance with Fed.R.Civ.P. 7.1(a))

Yes ☐ No ☒

Does this case involve multidistrict litigation possibilities?

Yes ☐ No ☒

RELATED CASE, IF ANY:

Case Number: \_\_\_\_\_ Judge \_\_\_\_\_ Date Terminated: \_\_\_\_\_

Civil cases are deemed related when yes is answered to any of the following questions:

1. Is this case related to property included in an earlier numbered suit pending or within one year previously terminated action in this court?

Yes ☐ No ☒

2. Does this case involve the same issue of fact or grow out of the same transaction as a prior suit pending or within one year previously terminated action in this court?

Yes ☐ No ☒

3. Does this case involve the validity or infringement of a patent already in suit or any earlier numbered case pending or within one year previously terminated action in this court?

Yes ☐ No ☒

4. Is this case a second or successive habeas corpus, social security appeal, or pro se civil rights case filed by the same individual?

Yes ☐ No ☒CIVIL: (Place ☒ in ONE CATEGORY ONLY)

## A. Federal Question Cases:

1. ☐ Indemnity Contract, Marine Contract, and All Other Contracts
2. ☐ FELA
3. ☐ Jones Act-Personal Injury
4. ☐ Antitrust
5. ☒ Patent
6. ☐ Labor-Management Relations
7. ☐ Civil Rights
8. ☐ Habeas Corpus
9. ☐ Securities Act(s) Cases
10. ☐ Social Security Review Cases
11. ☐ All other Federal Question Cases  
(Please specify)

## B. Diversity Jurisdiction Cases:

1. ☐ Insurance Contract and Other Contracts
2. ☐ Airplane Personal Injury
3. ☐ Assault, Defamation
4. ☐ Marine Personal Injury
5. ☐ Motor Vehicle Personal Injury
6. ☐ Other Personal Injury (Please specify)
7. ☐ Products Liability
8. ☐ Products Liability — Asbestos
9. ☐ All other Diversity Cases  
(Please specify)

**ARBITRATION CERTIFICATION**

(Check appropriate Category)

I, Bryan R. Lentz, Esquire, counsel of record do hereby certify:☒ Pursuant to Local Civil Rule 53.2, Section 3(c)(2), that to the best of my knowledge and belief, the damages recoverable in this civil action case exceed the sum of \$150,000.00 exclusive of interest and costs;☐ Relief other than monetary damages is sought.DATE: 6-5-15Bryan R. Lentz  
Attorney-at-Law71383

Attorney I.D.#

**NOTE:** A trial de novo will be a trial by jury only if there has been compliance with F.R.C.P. 38

I certify that, to my knowledge, the within case is not related to any case now pending or within one year previously terminated action in this court except as noted above.

DATE: 6-5-15Bryan R. Lentz  
Attorney-at-Law71383

Attorney I.D.#

## UNITED STATES DISTRICT COURT

**FOR THE EASTERN DISTRICT OF PENNSYLVANIA — DESIGNATION FORM** to be used by counsel to indicate the category of the case for the purpose of assignment to appropriate calendar.

Address of Plaintiff: 6071 Easton Road, Pipersville, Pennsylvania, 18947

Address of Defendant: See attached list

Place of Accident, Incident or Transaction: Eastern District of Pennsylvania  
(Use Reverse Side For Additional Space)

Does this civil action involve a nongovernmental corporate party with any parent corporation and any publicly held corporation owning 10% or more of its stock?

(Attach two copies of the Disclosure Statement Form in accordance with Fed.R.Civ.P. 7.1(a))

Yes ☐ No ☒

Does this case involve multidistrict litigation possibilities?

Yes ☐ No ☒

RELATED CASE, IF ANY:

Case Number: \_\_\_\_\_ Judge \_\_\_\_\_ Date Terminated: \_\_\_\_\_

Civil cases are deemed related when yes is answered to any of the following questions:

1. Is this case related to property included in an earlier numbered suit pending or within one year previously terminated action in this court?  
Yes ☐ No ☒
2. Does this case involve the same issue of fact or grow out of the same transaction as a prior suit pending or within one year previously terminated action in this court?  
Yes ☐ No ☒
3. Does this case involve the validity or infringement of a patent already in suit or any earlier numbered case pending or within one year previously terminated action in this court?  
Yes ☐ No ☒
4. Is this case a second or successive habeas corpus, social security appeal, or pro se civil rights case filed by the same individual?  
Yes ☐ No ☒

CIVIL: (Place ✓ in ONE CATEGORY ONLY)

**A. Federal Question Cases:**

1. ☐ Indemnity Contract, Marine Contract, and All Other Contracts
2. ☐ FELA
3. ☐ Jones Act-Personal Injury
4. ☐ Antitrust
5. ☒ Patent
6. ☐ Labor-Management Relations
7. ☐ Civil Rights
8. ☐ Habeas Corpus
9. ☐ Securities Act(s) Cases
10. ☐ Social Security Review Cases
11. ☐ All other Federal Question Cases  
(Please specify)

**B. Diversity Jurisdiction Cases:**

1. ☐ Insurance Contract and Other Contracts
2. ☐ Airplane Personal Injury
3. ☐ Assault, Defamation
4. ☐ Marine Personal Injury
5. ☐ Motor Vehicle Personal Injury
6. ☐ Other Personal Injury (Please specify)
7. ☐ Products Liability
8. ☐ Products Liability — Asbestos
9. ☐ All other Diversity Cases  
(Please specify)

**ARBITRATION CERTIFICATION**

(Check appropriate Category)

I, Bryan R. Lentz, Esquire, counsel of record do hereby certify:

☒ Pursuant to Local Civil Rule 53.2, Section 3(c)(2), that to the best of my knowledge and belief, the damages recoverable in this civil action case exceed the sum of \$150,000.00 exclusive of interest and costs;

☐ Relief other than monetary damages is sought.

DATE: 6-5-15

Bryan R. Lentz  
Attorney-at-Law

71383

Attorney I.D.#

NOTE: A trial de novo will be a trial by jury only if there has been compliance with F.R.C.P. 38

I certify that, to my knowledge, the within case is not related to any case now pending or within one year previously terminated action in this court except as noted above.

DATE: 6-5-15

Bryan R. Lentz  
Attorney-at-Law

71383

Attorney I.D.#

**DEFENDANTS**

**PEROXYCHEM, LLC**

1735 Market Street

Philadelphia, Pennsylvania, 19103

**SCOTT STEFFL**

1735 Market Street

Philadelphia, Pennsylvania, 19103

**BRUCE LERNER**

1735 Market Street

Philadelphia, Pennsylvania, 19103



**IN THE UNITED STATES DISTRICT COURT  
FOR THE EASTERN DISTRICT OF PENNSYLVANIA**

**CASE MANAGEMENT TRACK DESIGNATION FORM**

Innovative Environmental Technologies, Inc. :	CIVIL ACTION
v. :	
	NO.
Peroxychem, LLC SCOTT STEFFL,	
AND BRUCE LERNER	

In accordance with the Civil Justice Expense and Delay Reduction Plan of this court, counsel for plaintiff shall complete a case Management Track Designation Form in all civil cases at the time of filing the complaint and serve a copy on all defendants. (See § 1:03 of the plan set forth on the reverse side of this form.) In the event that a defendant does not agree with the plaintiff regarding said designation, that defendant shall, with its first appearance, submit to the clerk of court and serve on the plaintiff and all other parties, a case management track designation form specifying the track to which that defendant believes the case should be assigned.

**SELECT ONE OF THE FOLLOWING CASE MANAGEMENT TRACKS:**

- (a) Habeas Corpus – Cases brought under 28 U.S.C. §2241 through §2255. ( )
- (b) Social Security – Cases requesting review of a decision of the Secretary of Health and Human Services denying plaintiff Social Security Benefits ( )
- (c) Arbitration – Cases required to be designated for arbitration under Local Civil Rule 53.2. ( )
- (d) Asbestos – Cases involving claims for personal injury or property damage from exposure to asbestos. ( )
- (e) Special Management – Cases that do not fall into tracks (a) through (d) that are commonly referred to as complex and that need special or intense management by the court. (See reverse side of this form for a detailed explanation of special management cases.) ( )
- (f) Standard Management – Cases that do not fall into any one of the other tracks. (X)

6-5-15  
Date

Bryan R. Lentz, Esq.  
Attorney-at-law

(215) 735-3900  
Telephone

(215) 735-2455  
FAX Number

  
Attorney for Plaintiffs

blentz@bochettoandlentz.com  
E-Mail Address

**IN THE UNITED STATES DISTRICT COURT  
FOR THE EASTERN DISTRICT OF PENNSYLVANIA**

**INNOVATIVE ENVIRONMENTAL  
TECHNOLOGIES, INC.,**

*Plaintiff,*

**v.**

**PEROXYCHEM LLC, SCOTT STEFFL,  
AND BRUCE LERNER**

*Defendants.*

Civil Action No.

**JURY TRIAL DEMANDED**

**COMPLAINT**

Plaintiff Innovative Environmental Technologies, Inc. ("IET") by its undersigned counsel Bochetto & Lentz, P.C., for its Complaint against PeroxyChem LLC ("PeroxyChem"), alleges as follows:

**JURISDICTION AND VENUE**

1. This action arises under the patent laws of the United States, Titles 17 and 35 of the United States Code.
2. This Court has subject matter jurisdiction over IET's cause of action for patent infringement pursuant to 28 U.S.C. 1331 §§ and 1338 (a).
3. Venue properly lies in this District under the provisions of 28 U.S.C. §§ 1391.
4. This Court has personal jurisdiction over PeroxyChem because PeroxyChem has its principal place of business in Philadelphia, Pennsylvania and/or otherwise has substantial contacts in Pennsylvania.

**PARTIES**

5. IET is incorporated in Pennsylvania with its principal place of business located at

6071 Easton Road, Pipersville, Pennsylvania, 18947.

6. PeroxyChem is a Delaware Limited Liability Corporation having its principal place of business located at 1735 Market Street, Philadelphia, Pennsylvania, 19103.

7. Scott Steffl is the Global Business Director for Peroxychem and an adult individual who can be served at the offices of Peroxychem at 1735 Market Street, Philadelphia, Pennsylvania, 19103.

8. Bruce Lerner is the Chief Executive Officer of Peroxychem who may be served at the offices of Peroxychem at 1735 Market Street, Philadelphia, Pennsylvania, 19103.

### **BACKGROUND**

#### **A. PeroxyChem**

9. PeroxyChem is a global manufacturer and supplier of hydrogen peroxide, peracetic acid, persulfates and adjacent technologies.

10. Prior to February 28, 2014, PeroxyChem was a division of FMC Corp., operating as FMC Global Peroxygens. PeroxyChem literature, in many cases, still contains references to “FMC” or “FMC Environmental Solutions.”

11. PeroxyChem requires purchasers of many of its products to sign licensing agreements and/or pay licensing fees based upon PeroxyChem’s claim to certain intellectual property rights.

12. One of PeroxyChem’s products is “EHC,” which the PeroxyChem website describes as an In Situ Chemical Reduction (“ISCR”) reagent.

#### **B. PeroxyChem Infringement Of United States Patent No. 7,531,709**

13. IET is the owner of the right, title and interests in and to United States Patent No. 7,531,709 (“the 709 patent”), including the right to assert all causes of action arising under said



patent and the right to any remedies for infringement.

14. On May 12, 2009, the 709 Patent entitled “Method for Accelerated Dechlorination of Matter,” having a priority date of January 6, 2003, was duly and legally issued by the United States Patent and Trademark Office. (*See* a true and correct copy of the “709 Patent” attached hereto as **Exhibit “A”** and incorporated by reference.)

15. The 709 Patent is directed to “the accelerated dechlorination of subsurface matter by anaerobic microorganisms in conjunction with oxygen scavengers, vitamins, nutrients and zero valent metals.”

16. Independent claim 1 of the 709 Patent reads:

A method for accelerated anaerobic dechlorination of subsoil matter, comprising the steps of:  
supplying a mixture including a zero valent metal into soil pathways to biologically react with the dissolved chlorinated solvents in the groundwater; and  
supplying an organic hydrogen donor into the soil pathways to produce dechlorinating conditions such that indigenous anaerobic bacteria biodegrade residual concentrations of chlorinated solvents.

17. The remaining claims of the 709 Patent depend from claim 1 and further define the in situ process for dechlorination of subsoil matter.

18. Claim 3 describes a method of injection.

19. Claim 11 describes use of a mixture including “zero valent metal.”

20. The “summary of the invention” describes an embodiment involving “subsurface pathway development” and the use of “direct push technology.”

21. In addition, a “preferred embodiment” in the specification of the 709 patent describes in detail the “injection” of a bioslurry combined with “zero valent metal.”

22. PeroxyChem’s website markets EHC as a “technology” which “describes a family

of remediation products used for the *in situ* treatment of groundwater and saturated soil impacted by heavy metals and persistent organic compounds such as chlorinated solvents, pesticides and energetics.” (See a true and correct copy of PeroxyChem’s website describing a family of remediation products attached hereto as **Exhibit “B.”**)

23. The website further describes EHC as being “composed of controlled-release carbon, zero valent iron (ZVI) particles and nutrients used for stimulating *in situ* chemical reduction (ISCR) of otherwise persistent organic compounds in groundwater. Following placement of EHC into the subsurface environment, a number of physical, chemical and microbiological processes combine to create very strong reducing conditions that stimulate rapid and complete dechlorination of organic solvents and other recalcitrant compounds (e.g., explosives and organochlorine pesticides).” (See **Ex. B.**)

24. The FMC data sheet for EHC similarly describes it as “an in situ reagent chemical reduction (ISCR) product for remediation of impacted groundwater. It is composed of a mixture of food grade organic carbon and micro-scale zero-valent iron in a blended powder.” (See a true and correct copy of the FMC data sheet for EHC attached hereto as **Exhibit “C.”**)

25. The PeroxyChem Product Sheet lists “Installation Methods,” including Injection of EHC slurry via “Direct Push Technology” (“DPT”). (See a true and correct copy of the PeroxyChem Product Sheet attached hereto as **Exhibit “D.”**)

26. PeroxyChem also publishes “INSTALLATION PROCEDURES” for EHC which “provides guidelines for direct application into several methods - first, open excavation, then a discussion how to make a slurry and lastly injection guidelines.” (See a true and correct copy of PeroxyChem’s “INSTALLATION PROCEDURES” attached hereto as **Exhibit “E.”**)

27. PeroxyChem provides these installation instructions in conjunction with the sale

of EHC.

28. These installation methods and procedures describe the process protected by the 709 patent.

29. As a result, it is clear that PeroxyChem not only markets EHC for use in a process that infringes the 709 patent, but they also provide instructions to purchasers, describing how to employ the product in an infringing process following purchase.

**C. Direct Infringement of the 709 Patent**

30. In addition to marketing EHC on the company website in the manner described above, PeroxyChem also organizes forums all over the United States and internationally whose purpose is to market the EHC product.

31. At these forums, presenters, including PeroxyChem's employees provide specific instruction on how to employ EHC utilizing methods protected by the 709 Patent.

32. In addition, PeroxyChem employees have participated in projects and given specific instruction, consulted on, supervised, and/or assisted in the execution of remediation projects utilizing the methods described and protected by the 709 Patent.

33. In fact, on March 21, 2014, PeroxyChem admitted that their "EHC ISCR technology has been successfully used at thousands of sites around the world" over the course of ten years. (*See* a true and correct copy of PeroxyChem's March 21, 2015 website post attached hereto as **Exhibit "F."**)

34. Many of these "thousands" of projects were remediation projects wherein PeroxyChem employees knowingly participated in direct infringement or induced and or contributed to the infringement of the 709 Patent.

**D. Knowing Participation of PeroxyChem Officers**

35. Pursuant to 35 USC § 271(b), whoever actively induces infringement of a patent shall be liable as an infringer.

36. Accordingly, PeroxyChem's officers and directors can be held liable for actively inducing infringement.

37. The individual defendants, Steffl and Lerner had actual knowledge of the 709 Patent.

38. By way of example only, both Steffl and Lerner approved of and on multiple occasions relied upon the Peroxychem marketing and "INSTALLATION" materials which they knew described the methods protected by the 709 patent.

39. The individual defendants, Steffl and Lerner had actual knowledge that their conduct was inducing third parties to infringe Plaintiff's patent.

40. The defendants intentionally induced this conduct in order to increase profits at the expense of the rights of the Plaintiff.

41. Defendants knew that Plaintiff had obtained patent rights under the 709 Patent, which defendants disregarded in their efforts to induce third parties to infringe on Plaintiff's patent, in order to generate profits for the Defendants.

42. Defendants actively aided and abetted PeroxyChem and its predecessors, who willfully infringed upon the 709 patent.

43. At all times material, Defendants knew that their conduct would result in third parties engaging in actual infringement.

44. As referenced above, the PeroxyChem website and/or the marketing campaigns were authorized and approved by PeroxyChem officers and/or actively participated in by

PeroxyChem officers.

**COUNT I – INFRINGEMENT OF THE 709 PATENT BY PEROXYCHEM**  
**(IET v. PEROXYCHEM)**

45. Plaintiff incorporates by reference the averments set forth in each of the preceding paragraphs as if fully set forth herein.

46. As set forth above, Defendant PeroxyChem participated in direct infringement of the 709 Patent when they participated in projects and gave specific instruction, consulted on, supervised, and/or assisted in the execution of remediation projects utilizing the methods described and protected by the 709 Patent.

47. IET has suffered damages and a loss of royalties as a result of PeroxyChem's infringing activities and will continue to suffer damages in the future unless PeroxyChem is enjoined from further infringing on the 709 Patent.

**COUNT II – CONTRIBUTORY INFRINGEMENT OF THE 709 PATENT BY**  
**PEROXYCHEM**  
**(IET v. PEROXYCHEM)**

48. Plaintiff incorporates by reference the averments set forth in each of the preceding paragraphs as if fully set forth herein.

49. 35 USC § 271(c) states, in relevant part, that "whoever offers to sell or sells ... a material for use in practicing a patented process ... shall be liable as a contributory infringer." 35 U.S.C.A. § 271(c) (2010).

50. PeroxyChem has contributed to purchasers and/or users of EHC infringing and continues to contribute to purchasers/users to infringe the 709 Patent by marketing EHC and providing instructions for its use in a processes covered by one or more claims of the 709 Patent related to, inter alia, the Accelerated Dechlorination of Subsurface Matter.

51. Defendant's unlawful conduct induced or contributed to purchasers and/or users of EHC infringing the 709 Patent directly and under the doctrine of equivalence.

52. PeroxyChem has had actual knowledge of the 709 Patent and has willfully committed said infringing activities. These infringing activities violated and continue to violate 35 U.S.C. § 271 and entitle Plaintiff to an award of treble damages and attorney's fees.

53. IET informed PeroxyChem by written communication that PeroxyChem's activities in marketing EHC and providing instructions for using it in an infringing manner constitute contributory acts, demonstrating to third parties how to infringe on IET's 709 Patent.

54. IET has suffered damages and a loss of royalties as a result of PeroxyChem's activities and will continue to suffer damages in the future unless PeroxyChem is enjoined from further contributing to the infringement of the 709 Patent.

**COUNT III – INDUCING INFRINGEMENT OF THE 709 PATENT BY**  
**PEROXYCHEM**  
**(IET v. ALL DEFENDANTS)**

55. Plaintiff incorporates by reference the averments set forth in each of the preceding paragraphs as if fully set forth herein.

56. 35 USC § 271(b) states that "whoever actively induces infringement of a patent shall be liable as an infringer." 35 U.S.C.A. § 271(b) (2010).

57. PeroxyChem, through its officers and directors, actively and knowingly aided and abetted "thousands" of remediation projects, many of which infringed on the 709 Patent.

58. PeroxyChem and its officers have induced purchasers/ users of EHC, to infringe and continues to induce purchasers/users to infringe the 709 Patent by marketing EHC and providing instructions, advice and direction which induced others to employ the EHC technology in processes protected by one or more claims of the 709 Patent related to, inter alia, the Accelerated Dechlorination of Subsurface Matter.

59. Defendants' unlawful conduct induces purchasers /users of EHC to infringe the 709 Patent directly and under the doctrine of equivalence.



60. PeroxyChem and its officers had knowledge of the 709 Patent and have willfully committed said infringing activities. These infringing activities violated and continue to violate 35 U.S.C. § 271 and entitle Plaintiff to an award of treble damages and attorney's fees.

61. IET informed PeroxyChem by written communication that PeroxyChem's activities in marketing EHC and providing instructions for using it in an infringing manner constitute an improper inducement of others to infringe on IET's 709 Patent.

62. IET has suffered damages and a loss of royalties as a result of PeroxyChem's activities and will continue to suffer damages in the future unless PeroxyChem is enjoined from further infringing and/or inducing infringement of the 709 Patent.

**PRAYER FOR RELIEF**

**WHEREFORE**, IET respectfully requests that this Court grant the following relief:

- a. Declare that PeroxyChem has improperly infringed, contributed, induced others to infringe one or more of the claims of the 709 Patent;
- b. Grant an injunction enjoining and restraining PeroxyChem and its officers, directors, agents, servants, employees, attorneys, and all others acting under, by or through them, directly or indirectly, from continuing to market and sell EHC for use in processes covered by one or more claims of the 709 Patent related to, inter alia, the accelerated dechlorination of subsurface matter;
- c. Order PeroxyChem to pay damages under 35 U.S.C. § 284, including treble damages, with prejudgment interest;
- d. Declare this an exceptional case, and order PeroxyChem to pay the costs of this action and attorneys' fees as provided by 35 U.S.C. § 285, with prejudgment interest;

- e. Grant any and all such additional and further relief as this Court may deem just and equitable.

**JURY DEMAND**

IET hereby demands that all issues be determined by a jury.

Date: June 4, 2015

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# EXHIBIT “A”



US007531709B2

(12) **United States Patent**  
Scalzi et al.

(10) **Patent No.:** **US 7,531,709 B2**

(45) **Date of Patent:** **\*May 12, 2009**

(54) **METHOD FOR ACCELERATED  
DECHLORINATION OF MATTER**

(75) **Inventors:** Michael Scalzi, Doylestown, PA (US);  
Wade Meese, Worthington, OH (US)

(73) **Assignee:** Innovative Environmental  
Technologies, Inc., Doylestown, PA  
(US)

(\*) **Notice:** Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 241 days.

This patent is subject to a terminal dis-  
claimer.

(21) **Appl. No.:** 11/423,749

(22) **Filed:** Jun. 13, 2006

(65) **Prior Publication Data**

US 2006/0223162 A1 Oct. 5, 2006

#### **Related U.S. Application Data**

(63) Continuation of application No. 10/610,558, filed on  
Jul. 2, 2003, now Pat. No. 7,129,388.

(60) Provisional application No. 60/437,983, filed on Jan.  
6, 2003.

(51) **Int. Cl.**  
**A62D 3/00** (2007.01)

(52) **U.S. Cl.** ..... 588/316; 588/406; 588/415

(58) **Field of Classification Search** ..... 588/313,  
588/315, 316, 318, 319, 320, 402, 406, 415,  
588/261; 423/240 R, 240 S

See application file for complete search history.

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*Primary Examiner*—Edward M Johnson

(74) *Attorney, Agent, or Firm*—Gregory J. Gore

(57) **ABSTRACT**

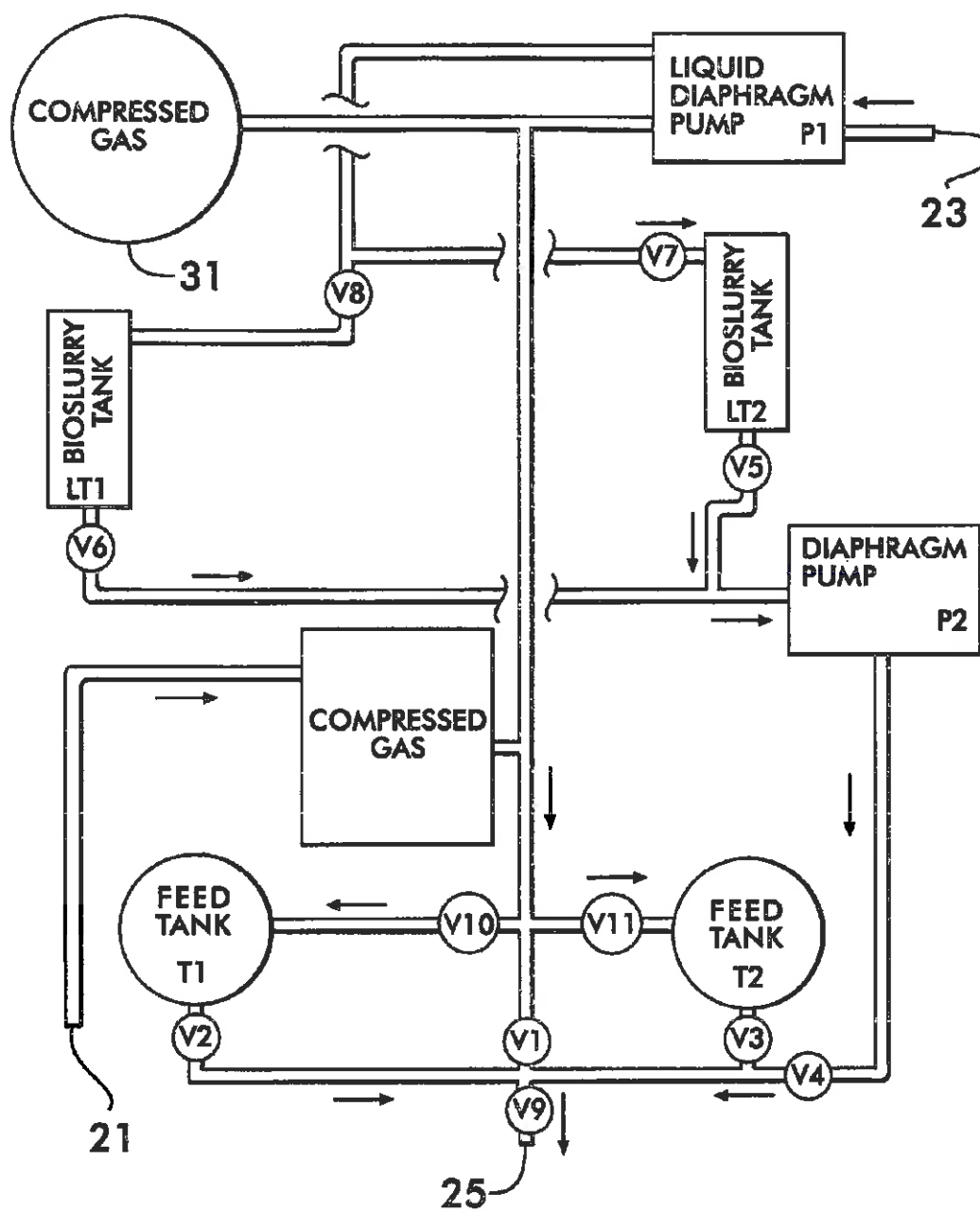
Accelerated dechlorination of soil and water contaminated with chlorinated solvents is achieved by stimulating anaerobic microorganisms and thus increasing the rate of biological mineralization of the solvents. This is accomplished by a treatment process consisting of colloidal suspension of metal powder, an organic hydrogen donor, chemical oxygen scavengers in solution with essential nutrients, and vitamin stimulants such as B2 and B12 delivered via compressed gases N or CO<sub>2</sub> so as not to oxygenate an environment targeted for anaerobic processes. The treatment stimulates naturally occurring microorganisms while oxidizing dissolved phase target compounds via the surface action of the iron particles resulting in the breakdown of chlorinated solvents such as tetrachloroethene, trichloroethene, carbon tetrachloride and their daughter products.

**16 Claims, 1 Drawing Sheet**

U.S. Patent

May 12, 2009

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**METHOD FOR ACCELERATED  
DECHLORINATION OF MATTER****RELATED APPLICATION**

This patent application is a continuation of co-pending patent application Ser. No. 10/610,558 filed Jul. 2, 2003 for "Method for Accelerated Dechlorination of Matter" which is related to provisional patent application Ser. No. 60/437,983 entitled "Method for Accelerated Dechlorination of Matter" filed on Jan. 6, 2003, priority from which is hereby claimed.

**FIELD OF THE INVENTION**

The present invention relates to the combined and synergistic utilization of chemicals in conjunction with the biomineralization processes of subsurface soil and groundwater pollutants. More specifically, it relates to an accelerated dechlorination of subsurface matter by anaerobic microorganisms in conjunction with oxygen scavengers, vitamins, nutrients, and zero valent metals.

**BACKGROUND OF THE INVENTION**

Through the years, chlorinated solvents have had a large impact on several industries, including pharmaceuticals, chemical processing, food extraction, dry cleaning, and metal cleaning. With wide spread use and improper handling and storage, extensive soil and water damage has occurred. Due to their toxicity, carcinogenicity, and persistence in the environment, chlorinated solvents are listed by the United States Environmental Protection Agency as high priority pollutants. If left untreated, chlorinated solvents may remain unchanged for a period of fifty years or more. The most common chlorinated solvents used are methylene chloride, tetrachloroethene, trichloroethene, carbon tetrachloride, chloroform, tetrachloroethane, dichloroethene and vinyl chloride. Carbon tetrachloride is a systematic poison of the nervous system, the intestinal tract, the liver, and the kidneys. Vinyl chloride and methylene chloride are known carcinogens, and could also affect the nervous system, the respiratory system, the liver, the blood, and the lymph system.

Chlorinated solvents are often found in separate phases mixtures commonly referred to as dense nonaqueous-phase liquids ("DNAPLs"). DNAPLs are visible, denser-than-water, separate oily phase materials in the subsurface whose migration is governed by gravity, buoyancy, and capillary forces. Chlorinated solvents partition into the water phase to create a dissolved contaminant plume when in contact with water, thus creating a long-term, continuing source of contamination as the soluble constituents slowly dissolve into moving groundwater.

One common technique for treating contaminated matter is the "pump-and-treat" method in which contaminated groundwater is pumped to the surface, cleaned chemically or by passing the groundwater through a bioreactor, and then re-injected into the groundwater. This process is carried out over a long period and various factors complicate the removal of these contaminants from the environment. Also, they are very volatile, highly mobile, denser than water, and generally found in the environment as mixtures of products with different degrees of chlorination. The "pump-and-treat" method is therefore problematic.

The problems with the "pump-and-treat" method can be overcome with the use of anaerobic microorganisms which have the capability to decompose a wide range of highly chlorinated compounds. However, anaerobic microorgan-

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isms are at a disadvantage in that their growth is slow when compared to that of aerobic organisms. In-situ they are at an even greater disadvantage due to the partitioning of the targeted substrates into the soil matrix. There is therefore a need in the art to utilize the ability of anaerobic microorganisms to decompose chlorinated compounds which can be achieved at a faster rate.

**SUMMARY OF THE INVENTION**

The present invention achieves accelerated dechlorination of soil and water contaminated with chlorinated solvents by stimulating anaerobic microorganisms and thus increasing the rate of biological mineralization of the solvents. This is accomplished by a treatment process consisting of a colloidal suspension of metal powder, organic hydrogen donor such as glucose, sucrose, alcohols, propionates, lactates, acetates, chitin, polylactate esters, glycerol tripolylactate, xylitol pentapolyolactate, and sorbitol hexapolyolactate, chemical oxygen scavengers in solution with essential nutrients, and vitamin stimulants such as B2 and B12 delivered via interconnected pneumatic pumps and pressurized vessels driven by compressed gases N or CO<sub>2</sub> so as not to oxygenate an environment targeted for anaerobic processes. The treatment stimulates naturally occurring microorganisms while addressing dissolved phase target compounds via the surface action of the metal particles. The overall effect results in the breakdown of chlorinated solvents such as tetrachloroethene, trichloroethene, carbon tetrachloride and their daughter products. The incorporation of the B12 acts as both an enzymatic stimulus for the anaerobic action and a surface catalyst of the iron particle. Cobalt, the core element of the B12, enhances the surface oxidation of the metal further.

A closed delivery system is used to deliver the process utilizing a combination of gas and liquid delivery systems. All of the vessels are interconnected and valved, allowing for mixings, washings, filling, and discharge of materials via pressure vessels or mechanical pumping systems. The system utilized allows for a variety of dissimilar compounds to be delivered via a single injection line. Further, the switching between feed systems is accomplished without any loss of pressure to the delivery line eliminating the common problems experienced from the vacuum developed down-hole as pressure is released and reapplied. Lastly, the current system is fully self-contained requiring no electrical supply. The only site utility requirement is an available water source for slurry preparation.

One embodiment of the present invention is carried out in the following steps.

**Step 1: Subsurface Pathway Development**

Initially, a gas is delivered to the subsurface via the delivery system further described herein. The gas is used so as not to introduce oxygen into an environment targeted for anaerobic processes. Injection points are advanced via traditional direct push technology or may be permanently installed injection wells. The gas is introduced at a maximum pressure of approximately 175 psi such that delivery pathways and voids are established. Pathway development is verified by observing a substantial pressure drop at the surface monitoring point. Gas introduction is immediately halted once the pressure drop is observed.

**Step 2: Sodium Sulfite Nutrient and Micro Nutrient Injection**

A solution of sodium sulfite and nutrients (nitrogen and ortho-phosphate) is immediately injected into the subsurface pathways and voids that were developed during the gas injection step. Sodium sulfite acts as an oxygen scavenger, iron



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reducer and sulfate source. As an oxygen scavenger, the sodium sulfite prevents the oxidation of the later-injected ZVI by the dissolved oxygen while promoting anaerobic conditions that are favorable for the biodegradation of the CVOCs. Nutrients, injected as organic ammonia and ortho-phosphate, are required for the maintenance of the microbial metabolic pathways, ATP/ADP synthesis and organelle development. Further, the incorporation of the ortho phosphate inhibits acetogenesis, a competing methanogenic reaction which consumes acetate and produces methane.

#### Step 3: Zero Valent Metal Injection

Immediately following the sodium sulfite/bioslurry solution injection, a colloidal suspension of a metal powder is added to an additional quantity of the bioslurry solution and the colloidal suspension is injected to reduce concentrations of dissolved-phase CVOCs while providing for rapidly generated hydrogen, the evolution of hydroxides and as a result overall microbial stimulation and biofilm formation.

#### Step 4: Anaerobic Hydrogen Source Injection

An anaerobic organic hydrogen source is injected immediately after the ZVI injection to provide a slow release hydrogen source for the anaerobic dechlorination of the CVOCs. Vitamin B12 and riboflavin B2 is mixed with the anaerobic stimulating hydrogen source to provide essential micro enzymes at the anaerobic sites.

#### Step 5: Sodium Sulfite/Nutrient Injection

A second injection of the sulfite/nutrient mixture is then performed to clear the injection lines and to provide for in-situ mixing and penetration of the anaerobic stimulating product.

#### Step 6: Post Liquid Injection—Gas Injection

Lastly, the injection lines are cleared of liquids by a second gas injection and all injectants are forced into the created formation and upward into the vadose zone. Once the injection cycle is complete, the injection point is temporarily capped to allow for the pressurized subsurface to accept the injectants. Once back-pressure diminishes, the injection rods are extracted. Injection boring locations are then sealed with bentonite or sand to prevent short-circuiting from adjacent injection locations.

Other objects and advantages of the present invention will be readily apparent to those of skill in the art from the following drawing and description of the preferred embodiment.

### BRIEF DESCRIPTION OF THE DRAWINGS

The FIGURE is an apparatus and flow diagram which describes an in-situ delivery system of the present invention.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

According to the preferred embodiment of the invention, the following process and delivery system apparatus is employed. In order to keep an anaerobic environment, nitrogen or carbon dioxide gas is used to propel all injectants into the subsurface. The gas is first injected into the subsurface at a maximum pressure of approximately 175 pounds per square inch until a significant pressure drop is observed at the injection pressure vessel. This process is referred to as delivery pathway development with the intent of opening pathways into the subsurface for the injections. These pathways are believed to be those more permeable pathways along which chlorinated solvents are more likely to have migrated, both in the vadose and saturated zones. Liquid and liquid-entrained

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injectants are then delivered with pressurized gas to the pathways that are produced during the pathway development.

Chemical oxygen scavengers, reducing agents such as sodium sulfite, are then injected to remove oxygen from groundwater and soil moisture immediately after pathway development in the subsurface, facilitating the anaerobic conditions that are preferred for the reductive dehalogenation of chlorinated solvents by indigenous bacteria. The resulting environment contains a wide spectrum of inorganic, biochemical, and enzymatic redox systems. Along with the reducing agents, nutrients such as organic ammonia and ortho-phosphate are added to the injectants in order to support microbial activity.

In an anaerobic environment, zero valent metal is then injected as an additive to the reducing agent bioslurry mixture. Zero valent metals have a moderately low toxicity and a good reducing power so that it can rapidly reduce higher concentrations of dissolved phase chlorinated solvents when injected via direct chemical reactions. Zero valent metals will continue to react with dissolved chlorinated solvents in groundwater until it is completely oxidized by chlorinated solvents, oxygen, or other oxidants that contact residual concentrations of zero valent iron. Under normal environmental conditions, zero valent metals are capable of being oxidized and reduced back and forth. The oxygen scavenger also promotes an anaerobic environment, stimulating the microorganisms.

With the addition of an electron donor source to provide hydrogen, the biodegradation process is initiated. An organic hydrogen donor such as a polylactate ester, glycerol tripolylactate, xylitol pentapolylactate, or sorbitol hexapolylactate, lactates, acetate, propionates, sugars, glucose, etc. is now injected with the intent of being cometabolized by indigenous anaerobic bacteria to produce dechlorinating conditions necessary for indigenous anaerobic bacteria to biodegrade residual concentrations of chlorinated solvents. This slow release process is controlled over time, maintaining a slow delivery of hydrogen at low concentrations which drives the anaerobic reductions. The volatile organic acid is then metabolized by indigenous bacteria to produce hydrogen, which can then be metabolized by chlorinated solvent degrading bacteria. Organic acids, hydrogen, nutrients, and bacteria then move with groundwater, enhancing the attenuation of chlorinated solvents as they move through the aquifer over a period of months.

The above-described process is preferably carried out by an apparatus such as shown in the diagram of the FIGURE. The direction of flow is indicated by arrows where appropriate. Not shown are conventional injection rods well-known in the art suitable for subsoil injections which are attached to an injection line in fluid communication with the discharge port

25. An embodiment of the inventive process begins by first filling the bioslurry tanks LT1 and LT2 and filling the feed tanks T1 and T2. A source of gas such as nitrogen or carbon dioxide is connected to inlet 21 and a water supply is connected to liquid inlet 23. Valves V7 and V8 are opened which engage an electric actuator to fill bioslurry tanks LT1 and LT2. The micro-nutrients/sodium sulfate is then manually added to the bioslurry tanks LT1 and LT2 and allowed to mix. Valves V7 and V8 are closed along with disengaging the actuator when the bioslurry tanks are filled.

Next, a pre-mixed heated lactate including vitamins B2 and B12 is manually poured into feed tank T1. Valves V5, V6, V4, and V3 are then opened. Next, pump P2 is activated and tank T2 is filled with an appropriate volume of the bioslurry. All valves are closed when finished. The tops are then secured on

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both feed tanks T1 and T2 and afterward valves V10 and V11 are opened to pressurize both feed tanks. After the injection rod has been properly placed at a selected location, the injection line is secured to discharge port 25 and valve V9 is opened.

The injection process begins when valve V1 is opened to create the injection pathways until a significant pressure drop is observed at the injection pressure vessel 31 which is filled with the source of compressed gas, preferably either nitrogen or carbon dioxide. Valve V1 is then closed and valve V3 opened to introduce the bioslurry mixture into the subsurface pathways from feed tank T2. Valve V3 is closed when feed tank T2 is empty.

Next, pump P2 is once again activated and tank T2 is filled with more of the bioslurry. Zero valent metal is then manually added and mixed with the bioslurry in tank T2. This mixture is then injected into the subsoil from tank T2 in the same way as the previous injection of the bioslurry mixture alone.

Now valve V2 is opened to introduce the lactate mixture into the subsurface from tank T1 and is closed after the tank is empty. Valves V4, V5, and V6 are then opened to directly deliver bioslurry from tanks LT1 and LT2 into the subsurface. All valves are closed when the desired amount of bioslurry has been injected. Finally, in order to cleanse the injection line of the viscous polylactate ester or other organic hydrogen donors, more reducing agent slurry is once again injected from tank T2 having been transferred there from tanks LT1 and LT2 as previously described. With the injections complete, a post injection line purge is performed by opening valves V9 and V1 and injecting gas to clear the lines of any remaining reducing agents. With the lines cleaned, the process is complete and the next injection location is prepared.

In accordance with the invention, a test was carried out and the following results observed. A site known to be contained with chlorinated solvents was geologically mapped. After determination of the subsurface contaminate concentrations, characteristics and the direction of flow of groundwater, a series of injection points were drilled. Contaminate concentrations of cis-1,2-DCE prior to the biodegradation process ranged from 6.6 ppb to 69 ppb. The initial concentration of VC ranged from 0.97 to 2 ppb. The initial concentration of TCE ranged from 0.23 to 12.0 ppb.

After determining the levels of the contaminants, biodegradation was initiated and maintained by the addition of iron powder, lactate, reducing agents, vitamin stimulants, and delivered by compressed gases and results were observed after four months. Iron powder was chosen for two primary reactions with chlorinated solvents, the first being the anaerobic iron corrosion reaction in which water is disassociated to form hydrogen gas, and the direct absorption of a chlorinated hydrocarbon onto the surface of the iron, followed by reductive dehalogenation. Four mechanisms are at work during the reductive process. First, the zero valent metals act as a reductant by supplying electrons directly from the metal surface to an absorbed halogenated compound. Next, hydrogen gas is generated by the anaerobic corrosion of the metallic iron by water. Third, metallic iron may act as a catalyst for the reaction of hydrogen with the halogenated hydrocarbon using the hydrogen produced on the surface of the iron metal as the result of anaerobic corrosion with water. Fourth, solubilized ferrous iron can also act as a reductant, albeit at a rate at least an order of magnitude slower.

At the end of the four month process, microbial processes are strongly active as demonstrated by the disappearance of tetrachloroethane, 1,1-TCA, and dichloromethane. The alkaline conditions over the four months would suggest that the chloride production observed is primarily due to the microbial dechlorination process. The 4,600 ppb increase in chlorides observed over the period suggest significant microbial activity. There appears to be no toxicity issues in any of the

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areas on site and there has not been any microbial accumulation of intermediates of the degradation pathways. As a by-product of the program, benzene has also been addressed in those areas where it has been found in the groundwater samples.

Therefore the foregoing description of the invention demonstrates that it provides a method for accelerated dechlorination of matter contaminated with chlorinated solvents utilizing mechanisms associated with zero valent metal oxidation. It shows that with the combination of organic acids, hydrogen donors, oxygen scavengers, nutrients and zero valent metal, when added to matter contaminated with chlorinated solvents, can provide a reducing environment. Thus, the compounds disclosed have shown great utility in aiding the destruction or inactivation of chlorinated solvents. The invention also confirms that zero valent metal, when added with other compounds which provide a source of electron donors, nutrients, and reducing agents, will stimulate naturally occurring microorganisms while oxidizing dissolved phase target compounds via the surface action of the iron particles resulting in the breakdown of chlorinated solvents.

It should be understood that there may be other modifications and changes to the present invention that will be obvious to those of skill in the art from the foregoing description, however, the present invention should be limited only by the following claims and their legal equivalents.

The invention claimed is:

1. A method for accelerated anaerobic dechlorination of subsoil matter, comprising the steps of:

supplying a mixture including a zero valent metal into soil pathways to biologically react with the dissolved chlorinated solvents in the groundwater; and  
supplying an organic hydrogen donor into the soil pathways to produce dechlorinating conditions such that indigenous anaerobic bacteria biodegrade residual concentrations of chlorinated solvents.

2. The method of claim 1 further including the step of supplying a reducing agent into said soil pathways to remove oxygen from groundwater and soil moisture.

3. The method of claim 1 wherein the steps of supplying said mixture and said organic hydrogen donor are carried out by placing an injection rod into the soil and then injecting them under pressure through an injection rod.

4. The method of claim 3 further including the preliminary step of injecting a gas under pressure through said injection rod and into said soil to establish preferential delivery pathways therein.

5. The method of claim 2 wherein said reducing agent is sodium sulfite.

6. The method of claim 1 wherein said organic hydrogen donor further includes vitamins B2 and B12.

7. The method of claim 1 wherein the mixture further includes nutrients.

8. The method of claim 7 wherein said nutrients are organic ammonia and ortho-phosphate.

9. The method of claim 1 wherein said organic hydrogen donor is from the group consisting of lactate, propionate, chitin, butyrate, acetate, sugars, glycerol tripolylactate, xylitol pentapolylactate, and sorbitol hexapolylactate.

10. The method of claim 4 wherein said gas is from the group of nitrogen and carbon dioxide.

11. The method of claim 1 wherein said mixture including a zero valent metal is a colloidal suspension in a sodium sulfite solution.

12. The method of claim 3 further including, after the step of injecting the organic hydrogen donor, an additional step of

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injecting into the soil a sodium sulfite and nutrient solution to provide for further in-situ mixing and penetration of anaerobic stimulating products.

13. The method of claim 4 further including a final step of gas injection to clear said injection rod and fluid conduit lines connected thereto.

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- 14. The method of claim 1 wherein said metal is iron.
- 15. The method of claim 1 wherein said metal is in a colloidal suspension.
- 16. The method of claim 15 wherein the colloidal suspension includes a reducing agent.

\* \* \* \* \*

# EXHIBIT “B”

5/14/2015

PeroxyChem: EHC® ISCR Reagent

[Home \(/\) / Environment \(/markets/environment\) / Soil and Groundwater \(/markets/environment/soil-and-groundwater\) / Products \(/markets/environment/soil-and-groundwater/products\) / EHC ISCR Reagent](#)

# EHC® ISCR Reagent

EHC® technology describes a family of remediation products used for the *in situ* treatment of groundwater and saturated soil impacted by heavy metals and persistent organic compounds such as chlorinated solvents, pesticides and energetics.

EHC is composed of controlled-release carbon, zero valent iron (ZVI) particles and nutrients used for stimulating *in situ* chemical reduction (ISCR) of otherwise persistent organic compounds in groundwater. Following placement of EHC into the subsurface environment, a number of physical, chemical and microbiological processes combine to create very strong reducing conditions that stimulate rapid and complete dechlorination of organic solvents and other recalcitrant compounds (e.g., explosives and organochlorine pesticides).

[Product Brochure \(/markets/environment/soil-and-groundwater/technical-documents/ehc-iscr-reagent/product-brochure\)](#)

[MSDS \(/markets/environment/soil-and-groundwater/technical-documents/ehc-iscr-reagent/ehc-iscr-reagent-msds-europe\)](#)

5/14/2015

PercyChem: EHC® ISCR Reagent

## Overview

### KEY BENEFITS

Stimulation of both abiotic and biotic reductive dechlorination

Demonstrated longevity of 4-5 years in field conditions

Combined approach minimizes the production of problematic daughter products, such as DCE and VC

ZVI corrosion (alkaline) and fermenting carbon (acidic) are balanced producing circumneutral pHs in contrast to either alone

Non-hazardous and safe to handle

### EXAMPLE

#### CONTAMINANTS

Chlorinated Solvents

Chlorobenzenes

Energetic Compounds

Most Pesticides

Haloalkanes

Nitrate Compounds

### IN SITU CHEMICAL REDUCTION

In situ chemical reduction (ISCR) is the combination of abiotic chemical reduction, using zero valent iron (ZVI) and/or reduced minerals (magnetite, pyrite), coupled with anaerobic bioremediation for the effective treatment of chlorinated solvents, pesticides, and energetics. Physical, chemical, and

### KEY FUNCTIONS

Direct push injection

Hydraulic fracturing

Pneumatic fracturing

Permeable reactive barriers



5/14/2015

PeroxChem: EHC® ISCR Reagent

biological processes combine to create an extremely reduced environment that stimulates chemical and microbiological dechlorination of otherwise persistent compounds.

### Case Studies

#### EHC® PRB for Treatment of CT Plume at a Grain Silo in Kansas (/markets/environment/soil-and-groundwater/case-studies/ehc/ehc-prb-for-treatment-of-ct-plume-at-a-grain-silo-site-in-kansas)

The EHC® PRB was installed as a line of direct push injection points across the width of the plume. Eight years after the installation the PRB is still supporting >90% reduction in inflowing CT concentrations and the downgradient plume has reduced significantly in size and concentration.

#### EHC® Reagent for Treatment of PCE Plume at a Former Dry Cleaner Site in Colorado (/markets/environment/soil-and-groundwater/case-studies/ehc/ehc-for-treatment-of-pce-plume-at-former-dry-cleaner-site-in-colorado)

EHC® Reagent injected via direct push across the plume area impacted primarily by PCE and TCE.

#### EHC® Reagent for Treatment of CT at an USDA Facility in Kansas

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(/markets/environment/soil-and-groundwater/case-studies/ehc/ehc-for-treatment-of-ct-at-an-usda-facility-in-kansas)

As featured in Journal of Environmental Monitoring, following a laboratory evaluation confirming treatability, EHC Reagent was injected via direct push at a hot-spot area for treatment of carbon tetrachloride (CT) in groundwater. Application of a liquid EHC formulation, composed of ferrous iron and a liquid organic carbon source, was also completed into the vadose zone.

EHC® Reagent for Treatment of TCE in Weathered Bedrock at the Former Atlas Missile Site in Colorado

(/markets/environment/soil-and-groundwater/case-studies/ehc/ehc-reagent-for-treatment-of-tce-in-weathered-bedrock-at-the-former-atlas-missile-site-in-colorado)

As featured in Remediation Journal, EHC Reagent was emplaced via hydraulic fracturing into fine-grained sandstone to remediate TCE in groundwater.

EHC® Reagent for Treatment of TCE DNAPL Source Area at an Industrial Facility in Oregon  
(/markets/environment/soil-and-groundwater/case-studies/ehc/ehc-reagent-for-treatment-of-tce-dnapl-source-area-at-industrial-facility-in-oregon)

As featured in Remediation Journal, EHC® Reagent and KB-1® Bioaugmentation Culture were injected across the highest concentration

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area from approximately 40 to 112 ft bgs using direct push. Prior to treatment dissolved phase concentrations ranged as high as 592,000 and 90,000 µg/L for TCE and cis-DCE, respectively.

[View all 16 EHC® ISCR Reagent case studies » \(/markets/environment/soil-and-groundwater/case-studies?fp=1269\)](#)

### Contaminants Treated

#### **Chlorinated Solvents**

[Tetrachloroethene \(PCE\) \(/\)](#)

[Trichloroethene \(TCE\) \(/\)](#)

[Dichloroethene \(cis and trans DCE\) \(/\)](#)

[Trichloroethane \(TCA\) \(/\)](#)

[Dichloroethane \(DCA\) \(/\)](#)

[Carbon tetrachloride \(/\)](#)

[Chloroethane \(/\)](#)

[Chloroform \(/\)](#)

[Chloromethane \(/\)](#)

[Chlorotoluene \(/\)](#)

[Methylene chloride \(/\)](#)

[Vinyl chloride \(/\)](#)

[Dichloropropane \(/\)](#)

[Dichloropropene \(/\)](#)

[Hexachlorobutadiene \(/\)](#)

[Tetrachloroethane \(/\)](#)

[Trichloropropane \(/\)](#)

[BCFE \(/\)](#)

[BCEM \(/\)](#)

#### **Phenols**

[Pentachlorophenol \(/\)](#)

#### **Pesticides & Herbicides**

[Kepone \(/\)](#)

[α-Chlordane \(/\)](#)

[Heptachlor Epoxide \(/\)](#)

[Lindane \(hexachlorocyclohexane\) \(/\)](#)

[DDT, DDD, DDE \(/\)](#)

[Toxaphene \(/\)](#)

[Dieldrin \(/\)](#)

[2,4-D \(/\)](#)

[2,4,5-T \(/\)](#)

[Endrin \(/\)](#)

#### **Miscellaneous**

[Polychlorinated biphenyls \(PCBs\) \(/\)](#)

[Nitrates \(/\)](#)

#### **Energetics**

[TNT \(/\)](#)

[DNT \(/\)](#)

[Nitroglycerine \(/\)](#)

[HMX \(/\)](#)

[RDX \(/\)](#)

[Perchlorate \(/\)](#)

#### **Heavy Metals**

[Antimony \(/\)](#)

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**Chlorobenzenes** [Arsenic \(/\)](#)  
[Chlorobenzene \(/\)](#) [Cadmium \(/\)](#)  
[Dichlorobenzene \(/\)](#) [Chromium \(/\)](#)  
[Trichlorobenzene \(/\)](#) [Cobalt \(/\)](#)  
[Lead \(/\)](#)  
**Haloalkanes** [Copper \(/\)](#)  
[Nickel \(/\)](#)  
[Selenium \(/\)](#)  
[Zinc \(/\)](#)  
[Dichlorodifluoromethane \(Freon 12\) \(/\)](#)  
[Trichlorofluoromethane \(Freon 11\) \(/\)](#)  
[Trichlorotrifluoroethane \(Freon 113\) \(/\)](#)  
[PFOS \(/\)](#)  
[PFOA \(/\)](#)

## About PeroxyChem

PeroxyChem is a global leader in peroxygen and adjacent chemistries. The company employs approximately 600 people throughout the world, with facilities in North America, Europe and Asia. With an unyielding commitment to safety at its core and backed by an exceptional team, the company prides itself on exemplary customer service, product quality, reliability and technical service. PeroxyChem manufactures high quality products and innovative applications developed as a result of innovation and superior technical expertise. We supply customized chemistries for electronics, energy, environmental, food safety, pulp, paper, polymer, and other industrial and consumer markets.

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# EXHIBIT “C”



Environmental Solutions



Soil &amp; Groundwater remediation

DATA SHEET

## EHC<sup>®</sup> ISCR Reagent

### Introduction

EHC<sup>®</sup> ISCR Reagent is an *in situ* chemical reduction (ISCR) product for remediation of impacted groundwater. It is composed of a mixture of food grade organic carbon and micro-scale zero-valent iron in a blended powder. EHC is composed of natural compounds that are non-toxic to humans and the environment. EHC is not intended for treatment of potable water or for human or animal consumption.

Typical Data	
Iron Content	Approx. 35%
Particle Size Distribution	> 99.5 % less than 2.000 mm
	> 95.0 % less than 1.000 mm
	> 80.0 % less than 0.500 mm
	> 70.0 % less than 0.300 mm
Typical Properties	
Appearance	Light-tan powder
Density	0.65 – 0.75 g/mL (40.6 – 46.8 lb/ft <sup>3</sup> )
Bulk Density	0.50 – 0.60 g/mL (31.2 – 37.5 lb/ft <sup>3</sup> )
pH (28.6% aqueous suspension, w/w)	5.1 – 7.4

### Standard Containers

50 lb bags on pallets; 40 bags per 1 pallet (2,000 lb net wt). Available in supersacs upon request and on a made to order basis.

EHC is classified as non-hazardous by the US DOT.

Under cool, dry storage conditions the shelf life of EHC is 4 years.

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Prior to working with EHC consult the Material Safety Data Sheet to understand proper safety, handling, storage and disposal procedures.

Any vessel that contains wet EHC or EHC and water must be vented due to potential pressure build up from fermentation gasses.

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FMC CORPORATION

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# EXHIBIT “D”





**Environmental  
Solutions**

**EHC®**  
*In Situ Chemical Reduction Reagent*  
**Product Sheet**

## EHC® The Original ISCR Reagent

EHC<sup>®</sup> *in situ* chemical reduction (ISCR) reagent is the original patented combination of controlled-release organic carbon and zero valent iron (ZVI) used for the treatment of groundwater and saturated soil impacted by persistent halogenated compounds, including chlorinated solvents, pesticides and organic explosives. The EHC formula is the culmination of years of research and successful field use. EHC is comprised of a synergistic mixture of micro-scale ZVI and a solid organic carbon source, stimulating both abiotic and biotic dechlorination mechanisms.

### Contaminants treated

- Chlorinated solvents including chlorinated ethenes, ethanes and methanes
- Energetic compounds such as TNT, DNT, HMX, RDX and perchlorate
- Most pesticides including DDT, DDE, dieldrin, 2,4-D and 2,4,5-T
- Chlorobenzenes including di- and tri-chlorobenzene
- Haloalkanes such as Freon 11, 12, and 113
- Nitrate compounds

### Applications

EHC can address a wide range of contaminant concentrations and has successfully been applied to treat large dilute plume areas, groundwater hot-spots, and high concentration source areas:

- **Permeable Reactive Barriers (PRBs) for Plume Control:** EHC has an estimated lifetime > 5 years in the subsurface, which makes it ideal for placement into PRBs. The first full-scale EHC PRB has been operating since 2005, and has continuously supported >90% CVOC removal under flow-through conditions.
- **Grid-Applications:** EHC is also commonly used for source area/hot-spot treatment, and the product's longevity allows for continued treatment of contaminants as they slowly back diffuse from the solid matrix to groundwater at sites with high concentrations of sorbed mass / NAPL. EHC successfully treated a site with starting TCE concentrations >800 mg/L.
- **Plume Treatment:** Designs with multiple PRBs have been employed for cost effective treatment of large dilute plume areas.

### Installation methods

- Injection of EHC Slurry via Direct Push Technology (DPT)
- Hydraulic or Pneumatic Fracturing (applied to fine-grain formations including weathered and fractured bedrock)
- Direct placement into open excavations or trench PRBs
- Deep soil mixing

### SPECIFICATIONS

#### Composition:

- Micro-scale ZVI (~40%)
- Controlled-release, food grade, complex organic carbon (~60%)
- Major, minor, and micronutrients
- Food grade organic binding agent

#### Packaging:

Delivered as a dry powder, available in 50-lb / 25 kg bags and 1 ton super sacs.

#### Health and Safety:

Completely non-hazardous and safe to handle.

#### Longevity:

3 to 5+ years, depending on application

\*Custom formulations available upon request



**PeroxyChem**

For information, visit [peroxychem.com](http://peroxychem.com) | 888.646.1000 | [info@peroxychem.com](mailto:info@peroxychem.com)

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# EXHIBIT “E”



Environmental Solutions



Soil &amp; Groundwater remediation

INSTALLATION PROCEDURES

## EHC® ISCR Reagent

### Introduction

EHC® *In Situ* Chemical Reduction (ISCR) Reagent is composed of food grade organic carbon and zero-valent iron for reduction of persistent organic and/or inorganic contaminants from the subsurface environment. EHC reagent has been employed for source area treatment, plume treatment and plume management using permeable reactive barriers (PRBs) and other methods such as:

- Injection into the subsurface as a slurry
- Application directly into open excavations or trenches as a dry powder
- Mixing directly into the soil using deep soil mixing equipment.

The choice of installation method will depend on your site-specific conditions, including treatment depth and geology.

This document provides guidelines for direct application into several methods – first open excavation, then a discussion how to make a slurry, and lastly Injection guidelines.

### Application into an Open Excavation

#### Excavation base

The most common application for direct placement of EHC reagent is the addition of EHC to saturated soil and/or standing groundwater at the base of an excavation following a source area removal (Figure 1). EHC can either be mixed into the backfill material prior to placement or applied in lifts and then mixed in place. It is advisable to mix the EHC with sufficient backfill to cover the thickness of the excavation that is expected to encounter groundwater, taking into account seasonal variability in the groundwater table.

The EHC powder could also be physically mixed into saturated soil at the base of an excavation using a backhoe. Depending on the remaining impacts and the treatment goals, an application rate of 0.5 - 5% of EHC by soil mass is generally recommended for backfill applications.



Figure 1: Backfill with 5% EHC by weight at an open excavation following source area removal

#### Trench/PRB

EHC reagent could also be added to a trench excavation to form a PRB for plume management (Figure 2). The trench is installed across the plume and backfilled with a mixture of EHC and sand up to the groundwater table to form a reactive zone. The groundwater is treated as it passes through the reactive barrier. In general, a higher application rate of 5 - 10% of EHC by soil mass is recommended to sustain continuous removal over time. The remainder of the trench is backfilled with clean fill material (e.g. pea gravel or sand).



Figure 2: Placement of a mixture of EHC and sand into a trench excavation to form a PRB for plume control



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Soil &amp; Groundwater remediation

**INSTALLATION PROCEDURES****Mixing of EHC with Backfill Material**

If wind is low, the dry powder can be mixed with the backfill at ground surface using construction equipment. Alternatively, the powder can be mixed into the backfill in the excavation using construction equipment and safe construction methods. If winds are high, it may be necessary to prepare a slurry of EHC containing a high percentage of solids and mix the slurry into the backfill or it may help to spray with water during application (Figure 3).

**Direct Soil Mixing**

The EHC reagent may also be placed directly on the bottom of an excavation either in dry powder form if winds are low, or in slurry form if winds are high. In such a case, it may be advisable to mix the powder or slurry into the native soil at the bottom of the excavation using construction equipment and safe construction methods. This will be particularly useful if contaminants are expected to be present in the remaining soil. For deeper impacts, deep soil mixing equipment such as a Lang tool could be used (Figure 4).

**Preparation of EHC Slurry**

EHC reagent may need to be mixed into a slurry to avoid loss of product or for direct push injections. The solids content of the slurry may vary between 20% - 40% solids as calculated as the mass of EHC divided by the mass of water plus EHC. EHC is delivered as a dry powder in 50-lb bags or 2,000 lb super sacks. Table 1 indicates the volume of water required to attain a given percent solids level for a 50-lb bag of EHC. The solids content being used may need to be modified depending on how well the slurry mixes with the backfill.

FMC recommends preparing the EHC slurries on site in a mixing tank with a paddle-mixer at the bottom (grout mixers) (Figure 5). The slurry is then transferred to a feed tank connected to a pump allowing for easy transfer of the slurry; the slurry could then be pumped straight into the application – either by excavation or injection pump.

The EHC slurry has also been prepared in a variety of other ways; everything from in-line automated mixing systems and recirculation of slurry using high-flow trash pumps to manual mixing using a hand-held drill with a mixing attachment. However, particularly for larger projects, a mechanical mixing system on site is recommended.

**Table 1: Volume of water required to attain different slurry solids contents per 50-lb bag of EHC**

Percent Solids Content	Mass of EHC (lbs)	Volume of Water (US gallons)
20%	50 lbs	24
30%	50 lbs	14
40%	50 lbs	9.5



Figure 3: Dry mixing of EHC (provided in Supersacks) and sand



Figure 4: Deep soil mixing using a Lang tool





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Soil &amp; Groundwater remediation

**INSTALLATION PROCEDURES****Application via Injection**

The preferred approach for injections is often in the top-down direction using an injection tip that directs the slurry horizontally, for example pressure activated direct push tips have been successfully utilized. For each injection point, the rods are initially advanced to the top of the targeted depth interval and a specified volume of slurry is injected before proceeding down to the next depth. The injections are to be evenly distributed over the targeted depth interval, using a vertical injection spacing of approximately 2-4 ft. We recommend injecting a small volume of water (15 USG) to clear the injection tip between batches and at the end of the injection.



Figure 5: Mixing of EHC slurry using recirculation

**Pump requirements**

FMC recommends using an injection pump that is capable of generating at least 500 psi of pressure at a flow rate of 5 gpm. The pump needs to be able to handle solids. For example piston pumps, grout pumps and progressing cavity pumps have worked well in the past, with a preference towards the piston and grout pumps. EHC<sup>®</sup> would typically be injected at pressures of 100 to 200 psi. However, higher pressures are sometimes required to initiate the injection. It would be ideal to have a higher pressure pump available on site that can generate over 500 psi and as high a flow rate as possible. Deeper installations may require higher injection pressures.



Figure 6: Injection photograph

**Other injections considerations**

We recommend having sufficient rod length and injection tips on site to allow 3 to 5 injection points to be capped overnight to prevent backflow if need be (more for shallow depths and less for deep installations).

**Health and Safety**

EHC ISCR reagent is completely non-hazardous and safe to handle. The EHC MSDS is posted on our web site: <http://www.environmental.fmc.com/resource-center>. When working with EHC, it is recommended to use standard personal protective equipment, including: safety glasses, chemically resistant boots and nitrile gloves. Dust mask may be required when in close contact with EHC under certain conditions. Additional safety equipment may be required for site operations.

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# EXHIBIT “F”

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## Celebrating Ten Years of EHC ISCR!

Friday, March 21, 2014

March marks two important milestones for PeroxyChem Environmental Solutions – our first month as an independent company and the tenth anniversary of EHC ISCR, an essential part of our portfolio of proven In Situ Chemical Oxidation (ISCO), In Situ Chemical Reduction (ISCR), bioremediation and stabilization technologies.

Ten years ago this month, environmental scientists at Dames & Moore/URS/Malcolm Pirnie-Chicago began working with researchers and technology originators at Adventus Canada to develop what we've come to know as EHC ISCR technology.

Their goal was a fine-grained version of their proprietary Daramend amendment that could be effectively introduced into a subsurface aquifer using direct push injection technology. Laboratory studies evaluated myriad formulations and compositions ultimately yielding EHC – Eh= Redox; C= Compound. The first full-scale EHC field project was implemented in 2005 to treat carbon tetrachloride in groundwater. Performance monitoring over the following 8 years demonstrated that the technology met all



objectives. Together Dr. Jim Mueller (Adventus) and Dr. Dick Brown (ERM) coined the acronym ISCR and the rest is history.

PeroxyChem's EHC ISCR technology has been successfully used at thousands of sites throughout the world. Visit [peroxychem.com/remediation](http://peroxychem.com/remediation) (<http://peroxychem.com/remediation>) to read more about EHC implementation in Wellington and at many other sites.

As PeroxyChem we look forward to continuing to develop sustainable technologies that support soil and groundwater remediation.

## About PeroxyChem

PeroxyChem is a global leader in peroxygen and adjacent chemistries. The company employs approximately 600 people throughout the world, with facilities in North America, Europe and Asia. With an unyielding commitment to safety at its core and backed by an exceptional team, the company prides itself on exemplary customer service, product quality, reliability and technical service. PeroxyChem manufactures high quality products and innovative applications developed as a result of innovation and superior technical expertise. We supply customized chemistries for electronics, energy, environmental, food safety, pulp, paper, polymer, and other industrial and consumer markets.

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